PHASE I: CONCEPT EXPLORATION

Step 1.0 Prepare the HF/S Program Plan

Objective: The objective of this process step is to produce the Human Factors/Safety Plan

Inputs: Inputs to this step include the system description and requirements, and constraints on the HF/S Program.

Output: The output of this step is the HF/S Program Plan itself.

1.1 Identify HF/S Objectives

1.1.1 Manpower objectives: Identify or develop personnel requirements, either in quantitative terms or as compared with the predecessor system.

1.1.2 Personnel objectives: Identify or develop the characteristics of operators, maintainers, or repairers; quantitative goals for personnel capabilities, if available.

1.1.3 Training objectives: identify the number of training hours in the predecessor system; statements addressing the projected use of advanced training technology or techniques, e.g. embedded training or intelligent tutoring.

1.1.4 Human Factors Engineering (HFE) objectives: Identify or develop requirements to ensure that the system is designed to accommodate personnel requirements. If there are known human performance or workload problems with the predecessor system, the goals should address the elimination or reduction of these problems. A goal should also address the establishing of a HFE program to ensure that human performance and workload issues detected during system development are eliminated.

1.1.5 System Safety objectives: Identify or develop safety goals. A goal should also address the establishing of a system safety program to ensure that safety issues detected during system development are eliminated.

1.1.6 Health Hazard objectives: if there are any known health hazards in the predecessor system, these should be described and goals should be stated to eliminate these hazards. A goal should also address the establishing of a health hazard assessment program to ensure that hazards detected during system development are eliminated.

1.1.7 Integrated HF/S objectives: Identify or develop goals for the integration of domains, such as reliance on the same front-end analysis, use of a common data base, and implementation of a test and evaluation program which applies equally to all domains.

1.1.8 Affordability objectives

- reduced acquisition costs through HFE/MPT/safety and health integration
- reduced acquisition costs through reduced need to redesign
- reduced life cycle costs through reduced and training

1.1.9 Design objectives:

- Identify objectives of the materiel acquisition process
- Mission objectives
  - reduce time to detect and range at detection
  - improve initial engagements
  - enhance target engagement performance
  - enhance performance throughout graceful degradation
  - enhance performance of theater management activities
  - enhance performance of command and control activities
  - enhance performance of surveillance activities
- Operability objectives
  - improve adequacy of communications
  - reduce error occurrence
  - enhance error recovery rates
  - make systems error tolerant
  - improve environmental effects
  - enhance information handling performance
  - ensure human-machine interface design compliance
- Maintainability objectives
  - improve fault detection performance
  - enhance fault isolation - troubleshooting performance
  - improve maintenance access
  - reduce time to repair
- Supportability objectives
  - improve system documentation
  - improve spares access
  - improve inventory techniques
- Survivability objectives
  - enhance protection systems and devices
  - enhance human performance wearing protective ensembles
  - improve countermeasures
- Habitability objectives
  - optimize free volume
  - enhance environmental effects
  - optimize traffic patterns
  - optimize workspace layout
- Safety design objectives
  - reduce hazards
  - improve design to remove hazards
  - improve guards
  - improve warnings and instructions
  - enhance safety procedures
- Installability design objectives

        - reduce time and accuracy in setting up
        - enhance performance in making and mating subassemblies
    - Usability design objectives
        - reduce operator/user problems
        - enhance user productivity

1.2 Identify HF/S Issues and Constraints

1.2.1 Identify HF/S Issues - - for each function identified in the mission scenarios:

- Identify where the mission requirement will impact human performance
    - assumed mission requirement capabilities which will affect the performance of a function
    - error tolerance or reduced margin for error
- Identify where the mission requirement will impact human safety or health
- Identify special requirements for human performance
    - requirements for performance in survival gear
    - requirements for continuous, sustained performance
    - accuracy limits
    - detection tolerances
- Identify expected safety/health hazards
    - explosion hazards
    - thermal hazards
    - mechanical hazards
    - electrical hazards
    - chemical hazards
- Identify special operational skills
    - cognitive skills (decision making)
    - mechanical skills
    - sensory-motor skills
    - verbal skills
    - organizational/management skills
- Identify special maintenance skills
    - see above for special requirements for human performance
- Identify operational manning constraints
    - constraints on numbers
    - constraints on quality
- Identify maintenance manning constraints
    - constraints on numbers
    - constraints on quality
- Identify training requirements and concepts
    - use of existing facilities and devices
    - use of training simulation
    - use of embedded training
    - use of intelligent tutorials
- Identify personnel selection approaches
    - constraints on personnel selection

1.2.2 Identify Constraints

- Personnel Utilization Constraints - constraints on:
  - personnel complement composition
  - role of the human in system operation
  - role of the human in system monitoring
  - role of the human in system maintenance
  - role of the human in system support
  - role of the human in system setup
  - implementation of automation
- Personnel Performance Constraints
  - Required levels of human performance
  - Requirements for sustained performance
  - Human performance objectives
  - Directed design decisions
  - System performance objectives impacting human performance
  - Information avail./quality constraints on human performance
  - Time constraints on human performance
  - Mission requirement constraints on human performance
  - Environmental constraints on human performance
  - Human capability constraints on human performance
  - System/equipment design constraints on human performance
  - Software design constraints on human performance
  - Procedural constraints on human performance
  - Operational constraints on human performance
  - Team performance requirements
  - Requirements for performance monitoring/measurement
  - Requirements for performance feedback
  - Duration of operation impact on performance
  - MTTR estimate effects on maintainer performance
  - Mean time to perform PM estimate effects on maintainer performance
- Personnel Safety & Health Constraints
  - Expected hazardous conditions
  - Directed design decisions
  - Mission requirement constraints on human safety and health
  - Environmental constraints on human safety and health
  - Human capability constraints on human safety and health
  - System/equipment constraints on human safety and health
  - Software constraints on human safety and health
  - Procedural constraints on human safety and health
  - Operational constraints on human safety and health
  - Biomedical constraints
  - Habitability constraints
  - Requirements for protective equipment
  - Requirements for warnings and alarms
- Personnel Availability Constraints constraints on:
  - number of operating personnel
  - number of maintenance personnel

- personnel workloads
- personnel workload distribution
- personnel selection
- reduced workload
- consolidation of functions
- crew collaboration

- Personnel Capability Constraints
  - Minimum skill level projection
  - Requirements for special skills
  - Requirements for new skills
  - Requirements for decision aids
  - Constraints on training overhead
  - Directed training decisions
  - Training effectiveness objectives
  - Constraints on training equipment and facilities
  - Constraints on the training pipeline
  - Requirements for embedded training
  - Requirements for computer assisted instruction
  - Requirements for cross training
  - Requirements for on-line tutorials/job performance aids

1.3 Identify Data Requirements and all Potential data Sources

1.3.1 Identify HF/S data requirements

- Identify HF/S evaluation data requirements
  - specify the data required in order to evaluate the effectiveness of HF/S application or to assess the personnel readiness of the system or item which had not had HF/S applied in its data requirements by each personnel readiness category:
    - personnel availability/utilization
    - personnel capability
    - personnel performance
    - personnel safety and health
- identify data reliability requirements in terms of the need for experimental control in the acquisition of the data. Data reliability requirements indicate the need for precision in the data as a function of the adequacy of the experimental controls applied in the acquisition of data. Data reliability is a measure of the amount of measurement error in the data and reliability is maximized (measurement error minimized) through strict control of data acquisition conditions.
- identify data validity requirements. data validity is an indication that the data measure what they were intended to measure. Data validity is an indication of the amount of sampling error in the data. Validity is maximized through application of sampling techniques to ensure a high degree of fidelity of the test situation to the actual situation
- identify data accuracy requirements. Data accuracy requirements indicate to what

extent will inaccuracies be accepted in test data
- Identify data needed for conduct of the HF/S program
  - data required to support generation of design concepts
  - data required for the conduct of HF/S T&E
  - data required as input to acquisition documentation

1.3.2 Identify HF/S data sources

- Identify data provided by the systems engineering program
- Identify data provided by the logistics support program
- Identify data provided by operational Coast Guard units

1.4 Identify HF/S Products by Acquisition Phase

1.4.1 Identify Concept Exploration Phase HF/S Products

- the HF/S Plan
- HF/S Inputs to the Project Management Plan (PMP)
- HF/S Inputs to the Acquisition Plan (AP)
- HF/S Inputs to the Mission Needs Statement (MNS)
- Products of the HF/S Front-End Analysis
- HF/S Design Concepts
- HF/S NDI/COTS selection results
- HF/S T&E Plan
- HF/S Inputs to the Test and Evaluation Master Plan (TEMP)
- HF/S Inputs to the Development Test Plan (DTP)
- HF/S Inputs to the Phase 1 Proposal (P1P)
- HF/S Inputs to the Preliminary Operational Requirements Document (PORD)
- HF/S Inputs to the Integrated Logistics Support Plan (ILSP)
- HF/S Inputs to the Life Cycle Cost Estimate (LCCE)
- HF/S Inputs to the Risk Management Plan (RMP)
- HF/S Inputs to the Cost Benefit Analysis (CBA)
- HF/S Inputs to the Acquisition Project Baseline (APB)
- HF/S Inputs to the Acquisition Phase Summary (APS)
- HF/S Inputs to KDP 2 Exit Criteria

1.4.2 Identify Demonstration and Validation Phase HF/S Products

- Updated HF/S Plan
- Updated HF/S Inputs to the Project Management Plan (PMP)
- Updated HF/S Inputs to the Acquisition Plan (AP)
- Updated HF/S Front-End Analysis
- Updated HF/S Design Concepts
- Updated HF/S NDI/COTS selection results
- HF/S Inputs to the Configuration Management Plan (CMP)
- HF/S Inputs to System Preliminary Designs
- Updated HF/S T&E Plan
- Updated HF/S Inputs to the Test and Evaluation Master Plan (TEMP)

- HF/S Inputs to the DT Plans and Reports
- HF/S Inputs to OT Plans and Reports
- HF/S Inputs to the Operational Requirements Document (ORD)
- Updated HF/S Inputs to the Integrated Logistics Support Plan (ILSP)
- Updated HF/S Inputs to the Life Cycle Cost Estimate (LCCE)
- Updated HF/S Inputs to the Risk Management Plan (RMP)
- Updated HF/S Inputs to the Cost Benefit Analysis (CBA)
- Updated HF/S Inputs to the Acquisition Project Baseline (APB)
- Updated HF/S Inputs to the Acquisition Phase Summary (APS)
- HF/S Inputs to RFPs and Source Selection
- HF/S Inputs to KDP 3 Exit Criteria

1.4.3 Identify Full Scale Development Phase HF/S Products

- Updated HF/S Program Plan
- Updated Project Management Plan (PMP)
- Updated HF/S Inputs to the Acquisition Plan (AP)
- Undated HF/S Front-End Analysis
- Updated HF/S Design Concepts
- Inputs to Engineering Models or Prototypes
- HF/S Inputs to Production Design Specifications
- Updated HF/S T&E Plan
- Updated HF/S Inputs to the Test and Evaluation Master Plan (TEMP)
- Updated HF/S Inputs to the DT Plans and Reports
- Updated HF/S Inputs to OT Plans and Reports
- HF/S Inputs to the Operational Requirements Document (ORD)
- Updated HF/S Inputs to the Integrated Logistics Support Plan (ILSP)
- HF/S Inputs to Logistic Support Implementation (OLSP)
- Updated HF/S Inputs to the Life Cycle Cost Estimate (LCCE)
- Updated HF/S Inputs to the Risk Management Plan (RMP)
- Updated HF/S Inputs to the Cost Benefit Analysis (CBA)
- Updated HF/S Inputs to the Acquisition Project Baseline (APB)
- Updated HF/S Inputs to the Acquisition Phase Summary (APS)
- Updated HF/S Inputs to RFPs and Source Selection
- HF/S Inputs to KDP 4 Exit Criteria

1.4.4 Identify Production and Deployment Phase HF/S Products

- Updated HF/S Program Plan
- Updated HF/S Inputs to the Acquisition Plan (AP)
- HF/S Equipment Installation Criteria
- HF/S requirements for Engineering Change Proposals (ECPs)
- HF/S Inputs to Technical Data and Procedures
- HF/S Lessons Learned
- Updated HF/S Inputs to the Integrated Logistics Support Plan (ILSP)
- HF/S Inputs to Logistic Support Implementation (OLSP)
- Updated HF/S Inputs to the Acquisition Project Baseline (APB)

1.5 Identify HF/S Activities by Acquisition Phase

1.5.1 Identify Concept Exploration Phase HF/S Activities

- Prepare the HF/S Program Plan
- Conduct the HF/S Front-end Analysis
- Develop HF/S Design Concepts
- Plan and Conduct HF/S T&E
- Define Requirements for HF/S Analyses, Studies and Assessments
- Prepare HF/S Inputs to KDP 2

1.5.2 Identify Demonstration and Validation Phase HF/S Products

1.5.3 Identify Demonstration and Validation Phase HF/S Activities

- Update the HF/S Program Plan
- Update the HF/S Front-end Analysis
- Update HF/S Design Concepts
- Conduct HF/S Studies and Analyses
- Plan and Conduct HF/S T&E
- Provide HF/S Inputs to Procurement
- Update HF/S Inputs to System Documentation

1.5.4 Prepare HF/S Inputs to KDP 3

1.5.5 Identify Full Scale Development Phase HF/S Activities

- Update the HF/S Program Plan
- Update the HF/S Front-end Analysis
- Conduct HF/S Studies and Analyses
- Implement a Health and Safety Program
- Perform HF/S Detail Design
- Plan and Conduct HF/S T&E
- Provide HF/S Inputs to Procurement
- Prepare HF/S Inputs to KDP 4

1.5.6 Identify Production and Deployment Phase HF/S Activities

- Update the HF/S Program Plan
- Prepare HF/S Equipment Installation Criteria
- Identify HF/S requirements for Engineering Change Proposals (ECPs)
- Provide HF/S Inputs to Technical Data and Procedures
- Identify HF/S Lessons Learned
- Provide HF/S Updates to System Acquisition Documentation

1.6 Identify Requirements for Interaction with other Program Elements

1.6.1 Identify requirements for HF/S Inputs to and outputs from the System Engineering

Program

- Identify requirements for HF/S Inputs to and outputs from the ILS Program
- Identify requirements for HF/S Inputs to and outputs from the T&E Program
- Identify requirements for HF/S Inputs to and outputs from the Cost Analysis Program
- Identify requirements for HF/S Inputs to and outputs from the Risk Management Program
- Identify the roles of HF/S in the project work breakdown structure (WBS)
- Organize the HF/S IPT within the System Engineering program
  - Identify the HF/S project manager
  - Identify HF/S team leaders
  - Identify HF/S personnel
  - Obtain commitments for personnel assignments
  - Organize the HF/S Integrated Project Team (IPT)
  - Schedule and conduct meetings of the HF/S IPT
  - develop and recommend changes to resolve issues
  - Provide reports of HF/S program status

1.7 Identify HF/S Schedule and Level of Effort by Phase

1.7.1 Schedule HF/S activities for each acquisition phase

1.7.2 Determine the level of effort needed for each HF/S activity in each phase

1.8 Identify HF/S Personnel Qualifications

1.8.1 Identify personnel qualifications for each activity conducted in each acquisition phase

1.8.2 Identify personnel qualifications of subcontractors for each activity conducted in each acquisition phase

1.9 Identify HF/S Resource Requirements

1.9.1 Identify personnel resources required

1.9.2 Identify instrumentation and facility requirements

1.9.3 Identify funding requirements

1.9.4 Identify computer resource requirements

1.9.5 Identify modeling and simulation resource requirements

1.9.6 Identify T&E resource requirements

1.10 Package the HF/S Plan

1.10.1 Prepare the HF/S Plan

1.10.2 Package the HF/S Plan

1.10.3 Provide inputs to the Project Management Plan (PMP) - The PMP supports the Project Manager in the conduct of 4 functions: planning, organizing, directing, and controlling. The activities associates with each function, and the HF/S contribution, in the HF/S Plan, are described below:

- Planning
  - Activities
    - develop detailed objectives for the coming project phase;
    - define activities and tasks for each project functional area;
    - develop a project schedule.
  - HF/S Contribution
    - define HF/S objectives (from section 1.1);
    - define HF/S activities for the coming phase (section 1.4);
    - define the schedule for HF/S activities (section 1.7).
  - Organizing
  - Activities
    - define project activities and tasks;
    - consolidate resource requirements;
    - obtain task commitments;
    - finalize the project work breakdown structure, schedule networks, and task descriptions;
  - HF/S Contribution
    - define HF/S activities and tasks (section 1.4);
    - define HF/S resource requirements (section 1.9)
    - define HF/S inputs to the project work breakdown structure (section 1.6.6) , schedule networks (section 1.7), and task descriptions (section 1.4).
- Directing
  - Activities
    - establish communications;
    - involve project personnel in resolving issues;
    - encourage innovation and active participation.
  - HF/S Contribution
    - establish communications among HF/S IPT team members, and between the HF/S IPT and other program elements (section 1.6);
    - involve project personnel in resolving issues (section 1.2 for issue identification, and section 1.6 for IPT actions;
    - encourage innovation and active participation of HF/S participants (section 1.6)
- Controlling
  - Activities
    - require and receive status reports;
    - develop and direct changes to resolve issues;
    - develop and direct staffing actions;
    - provide status reports.

- HF/S Contribution
  - prepare HF/S status reports (section 1.6);
  - develop and direct changes to resolve issues (section 1.2 and 1.6);
  - develop and direct staffing actions (section 1.8);
  - provide status reports (section 1.6).